

REMARKS

The drawings were objected to because a clear illustration of the first embodiment of the present invention is not shown. In a telephonic interview conducted on December 8, 2003, the Examiner stated that a drawing similar to the one sent by facsimile to Applicant's attorney, a copy of which was also attached to the Office Action to which this Amendment is responsive, would be sufficient to illustrate the first embodiment of the invention and allow the reinstatement of cancelled claims 3, 4, 7, 8, 11, and 12. Proposed Fig. 12 enclosed herewith is similar to the Examiner's proposed drawing. Some important differences are as follows.

First, V_{Hsub} , V_{Bsub} , and V_{Lsub} are all lower than the corresponding voltage level of the photo-electric conversion unit 101 which is supported by, for example, Fig. 2. In contrast, the Examiner's proposed drawing shows each of V_{Hsub} , V_{Bsub} , and V_{Lsub} to be at least equal to the voltage of the photo-electric conversion unit 101.

Second, ϕ_{tg} in Fig. 12 is the potential of signal read-out portion 120, not the potential of transfer gate 105/106 as shown in the Examiner's drawing.

In support of the conclusion that ϕ_{tg} is the potential of signal read-out portion 120, please note that Fig. 1 shows that " V_{Mcl} " is electrode voltage and the voltage V_{Mcl} is applied to an electrode to time t_4 . Fig. 8 shows that a part of second charge transfer electrode 106 is placed in signal read-out portion 120. Further, on page 9, lines 8-11 of the specification, it is disclosed that "When ϕ' becomes equal to or shallower than ϕ_{tg} , the charges stored in photo-electric conversion unit 101 flows through signal read-out portion 120 into vertical charge transfer unit 102."

Consequently, on page 9, lines 3-7, it is obvious that the voltage V_{Mcl} is applied to second charge transfer electrode 106, the potential ϕ_{tg} is the potential of signal read-out portion

120 and that ϕ_{tg} is caused by the voltage V_{Mcl} . Page 9, lines 3-7, has been amended to clarify this.

New claims 13-18 reinstate cancelled claims 3, 4, 7, 8, 11, and 12, respectively.

Claims 1, 2, 9, and 10 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawahara et al., U.S. Patent No. 4,696,021, in view of Applicant's Admitted Prior Art (AAPA). Claims 5 and 6 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawahara et al., in view of AAPA and Lee et al., U.S. Patent No. 5,903,021.

A potential barrier under overflow control gate 4 in Kawahara et al. is not raised up in Figs. 4A to 4G.

A potential barrier under clear gate 8 in Kawahara et al. is maintained between overflow drain (OFD) 2' and vertical transfer CCD 3, as shown in Figs. 4A to 4G, and is not maintained between the overflow drain and photo-electric conversion unit.

Further, Figs. 4D and 4E ($t_5 < t < t_6$) in Kawahara et al. shows operations of a CCD in an exposure time ($t_3 < t < t_6$) of Fig. 3 and that signal charges produced at photodiode 1 transfer to the vertical transfer CCD 3 in $t_5 < t < t_6$ (see column 5, line 67, to column 6, line 6). In other words, in Kawahara et al., an exposure operation and an operation of reading out from photodiodes 1 to the vertical transfer CCD 3 are carried out at the same time. In the exposure operation and operation of reading out, (see Figs. 4D and 4E), the potential barrier under clear gate 8 is decreased and fixed.

On the other hand, in the present invention and the prior art discussed in the present application, an exposure operation and an operation of reading out from the photo-electric conversion unit are carried out separately. The electric potential barrier is raised up for the operation of reading out more than for the exposure operation.


CLOSING

An earnest effort has been made to be fully responsive to the Examiner's objections. In view of the above amendments and remarks, it is believed that independent claim 1 is in condition for allowance, as well as those claims dependent therefrom. Passage of this case to allowance is earnestly solicited.

However, if for any reason the Examiner should consider this application not to be in condition for allowance, he is respectfully requested to telephone the undersigned attorney at the number listed below prior to issuing a further Action.

Any fee due with this paper, not fully covered by an enclosed check, may be charged on Deposit Account 50-1290.

Respectfully submitted,


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Enclosure: New Fig. 12

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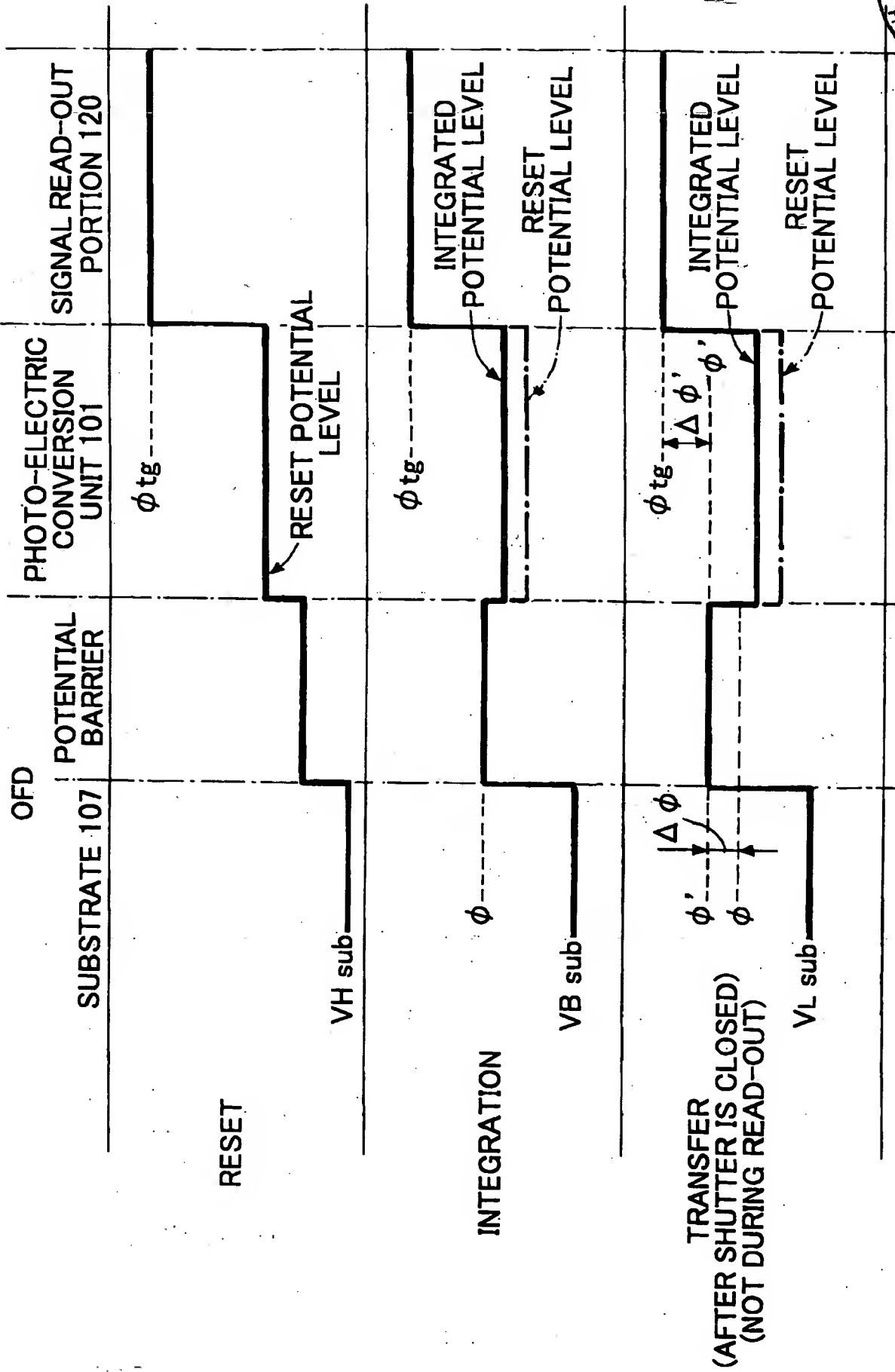


FIG. 12

